

[0096]

CLAIMS

[0097] We claim:

- 1 1. A method of PECVD depositing an a-SiN_x:H dielectric film useful in a TFT
2 device as gate dielectric, when a series of TFT devices are arrayed over a substrate
3 having a surface area larger than about 1 m², said method comprising:
4 depositing said a-SiN_x:H dielectric film over a substrate which is at a
5 temperature ranging from about 120 °C to about 340 °C;
6 depositing said a-SiN_x:H dielectric film at a process pressure which ranges
7 between about 1.0 Torr to about 2.0 Torr;
8 depositing said a-SiN_x:H dielectric film from precursors including N₂, NH₃,
9 and SiH₄, and wherein a component ratio of NH₃/SiH₄ ranges from about 5.3 to about
10 10.0, a component ratio of N₂/SiH₄ ranges from about 5.5 to about 18.7, and a
11 component ratio of N₂/NH₃ ranges from about 0.6 to about 2.3; and
12 applying a plasma to a mixture of said precursors, so that the plasma density in
13 a process chamber in which said a-SiN_x:H dielectric film is deposited ranges between
14 about 0.2 W/cm² and about 0.6 W/cm².
- 1 2. A method in accordance with Claim 1, wherein an electrode spacing in said
2 process chamber ranges from about 400 mils to about 1000 mils.
- 1 3. A method in accordance with Claim 1 or Claim 2, wherein said substrate
2 temperature ranges from about 240 °C to about 320 °C.
- 1 4. A method in accordance with Claim 1 or Claim 2, wherein said pressure in
2 said process chamber is less than about 1.5 Torr.
- 1 5. A method in accordance with Claim 1, wherein said substrate surface area is
2 larger than about 2.7 m².
- 1 6. A method in accordance with Claim 5, wherein said substrate surface area is

2 larger than about 4.1 m².

1 7. A method in accordance with Claim 6, wherein said substrate surface area is
2 larger than about 9.0 m².

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4 8. A method in accordance with Claim 1, wherein said substrate surface area
5 ranges between about 1.0 m² and about 4.1 m².

1 9. A method in accordance with Claim 1, wherein a deposition rate of said a-
2 SiN_x:H dielectric film is at least 1000 Å/min.

1 10. A method in accordance with Claim 9, wherein said deposition rate is at least
2 1300 Å/min.

1 11. A method in accordance with Claim 10, wherein said deposition rate is at least
2 1,600 Å/min.

1 12. A method in accordance with Claim 11, wherein said deposition rate is at least
2 2300 Å/min.

1 13. A method in accordance with Claim 12, wherein said deposition rate is at least
2 3000 Å/min.

1 14. A method in accordance with Claim 1, wherein a deposition rate of said
2 a-SiN_x:H dielectric film ranges between about 1000 Å/min and 2300 Å/min.

1 15. A method in accordance with Claim 1, wherein the variation in said film
2 thickness over said substrate is less than about 16 %.

1 16. A method in accordance with Claim 1, or Claim 15, wherein the atomic % of
2 Si-H bonded structure is less than about 20 %.

1 17. A method in accordance with Claim 16, wherein the atomic % of Si-H bonded
2 structure is less than about 15 %.

1 18. A method in accordance with Claim 1, wherein a wet etch rate of said film in a
2 solution of 7 % by weight hydrofluoric acid, 34 % by weight ammonium fluoride, and 59
3 % by weight water at a temperature of about 25 °C is less than 800 Å/min.

1 19. A method of PECVD depositing an a-SiN_x:H dielectric film useful in a TFT
2 device as a passivation dielectric, when a series of TFT devices are arrayed over a
3 substrate having a surface area larger than about 1m², said method comprising:

4 depositing said a-SiN_x:H dielectric film over a substrate which is at a
5 temperature ranging from about 120 °C to about 340 °C;

6 depositing said a-SiN_x:H dielectric film at a process pressure which ranges
7 between about 1.0 Torr to about 2.0 Torr;

8 depositing said a-SiN_x:H dielectric film from precursors including N₂, NH₃,
9 and SiH₄, and wherein a component ratio of NH₃/SiH₄ ranges from about 5.3 to about
10 11.1, a component ratio of N₂/SiH₄ ranges from about 5.8 to about 20.8 and a component
11 ratio of N₂/NH₃ ranges from about 0.5 to about 3.9; and

12 applying a plasma to a mixture of said precursors, so that the plasma density in
13 a process chamber in which said a-SiN_x:H dielectric film is deposited ranges between
14 about 0.2 W/cm² and about 0.6 W/cm².

1 20. A method in accordance with Claim 19, wherein an electrode spacing in said
2 process chamber ranges from about 400 mils to about 1000 mils.

1 21. A method in accordance with Claim 19 or Claim 20, wherein said substrate
2 temperature ranges from about 240 °C to about 320 °C.

1 22. A method in accordance with Claim 19 or Claim 20, wherein said pressure in
2 said process chamber is less than about 1.5 Torr.

23. A method of PECVD depositing an a-SiN_x:H dielectric film useful in a TFT device as a passivation dielectric, when a series of TFT devices are arrayed over a substrate having a surface area larger than about 1 m², said method comprising:

- depositing said a-SiN_x:H dielectric film over a substrate which is at a temperature ranging from about 120 °C to about 340 °C;
- depositing said a-SiN_x:H dielectric film at a process pressure which ranges between about 1.0 Torr to about 2.0 Torr;
- depositing said a-SiN_x:H dielectric film from precursors including N₂, NH₃, and SiH₄, and wherein a component ratio of NH₃/SiH₄ ranges from about 5.0 to about 8.0, a component ratio of N₂/SiH₄ ranges from about 5.0 to about 6.0 and a component ratio of N₂/NH₃ ranges from about 0.6 to about 1.2; and
- applying a plasma to a mixture of said precursors, so that the plasma density in a process chamber in which said a-SiN_x:H dielectric film is deposited ranges between about 0.2 W/cm² and about 0.6 W/cm².